II. CLAIM LISTING

What is claimed is:

Claim 1: (Currently amended) A method of repairing a metal rail, which rail includes head, upright web and base sections, said method comprising the steps of:

a) identifying and locating a defect in the metal rail;

b) removing the defect from the metal rail by removing the defect and metal material surrounding the defect, so as to expose parent metal of said rail in opposed, substantially parallel walls and a floor extending therebetween, form a void and a rail-void interface at said walls and floor, while maintaining continuity of the base and at least a portion of the web of the metal rail;

c) filling the void with molten metal; and

d) causing the molten metal and the metal rail at the rail-void interface to bond by fusion of said molten metal to said parent metal when said molten metal and rail are at a sufficiently elevated temperature to enable fusion.

Claim 2: (Original) A method as in Claim 1 wherein the void is filled with molten metal by arc welding.

Claim 3: (Original) A method as in Claim 2 wherein the void is filled using gas shielded arc welding.

Claim 4: (Original) A method as in Claim 3 wherein a high carbon welding electrode is used to fill in the void.

Claim 5: (Currently amended) A method as in Claim 4 wherein the carbon percentage in the welding electrode is from, by weight, about 0.1% to about 1.2% carbon.

Claim 6: (Currently amended) A method as in Claim 4 wherein the high carbon welding electrode produces a weld deposit from, by weight, about 0.2% to about 1.0% carbon,

from about 1.8% to about 2.0% manganese, from about 0.5% to about 0.6% nickel and from about 0.5% to about 0.95% silicon.

Claim 7: (Original) A method as in Claim 1 wherein the method includes the step of solidifying the molten metal and solidified metal is substantially free of inclusions.

Claim 8: (Original) A method as in Claim 1 wherein the method includes the step of solidifying the molten and solidified metal and rail each include carbon wherein the carbon content of the molten metal is approximately equal to the carbon content of the rail.

Claim 9: (Original) A method as in Claim 1 wherein the quantity of heat introduced by the molten metal is minimized.

Claim 10: (Original) A method as in Claim 1 wherein the void is formed by machining.

Claim 11: (Original) A method as in Claim 1 wherein the void is formed by cutting.

Claim 12: (Original) A method as in Claim 1 wherein the void is formed by grinding.

Claim 13. (Original) A method as in Claim 1 wherein the void is slot-shaped and includes a lower portion shaped to form a weld root.

Claim 14. (Original) A method as in Claim 13 wherein the weld root is bevel-shaped.

Claim 15. (Original) A method as in Claim 13 wherein the weld root is J-shaped.

Claim 16. (Original) A method as in Claim 1 wherein the weld metal includes from about 0.1% to about 1.2% by weight carbon.

Claim 17. (Original) A method as in Claim 1 wherein the annealing effect and heat affected zone of the rail-void interface is minimized.

Claim 18. (Original) A method as in Claim 2 wherein the inert gas shielded arc welding employs a solid weld electrode.

Claim 19. (Original) A method as in Claim 18 wherein the solid electrode has been treated so as to remove hydrogen and minimize hydrogen embrittlement.

Claim 20. (Currently amended) A railroad rail head repair comprising a rail having a head, a base and a web interconnecting the head and base;

the head including a flaw;

a gap formed in a portion of the rail;

said gap formed by mechanically slotting the rail so the base and at least a portion of the web remain continuous, said gap encompassing the location of the flaw, said gap eliminating the flaw from the rail, while metallurgically preserving the parent metal of the rail;

said gap extends at least through a portion of the head, and does not extend so far as to include the base;

a removable mold positioned on the rail, surrounding the gap;

a weld fill material having a high carbon content, approximating the carbon content of the rail, the weld fill material being melted to form molten metal, the molten metal positioned within and completely filling the gap, the molten metal permitted to cool, fusing to the metal of said rail, and solidifying in said gap.

Claim 21. (Original) The method of claim 16 further comprising the weld metal includes from about 0.55% to about .95% by weight carbon.

Claim 22. (Currently amended) The method of claim 1 wherein the void is filled with molten metal using a high temperature, fusion producing process comprising one of: (a) gas

shielded metal arc welding, (b) the submerged arc process, (c) electroslag arc welding process, or (d) hidden arc welding process, ~~(e) thermite welding or (f) casting~~.

Claim 23. (Original) The method of claim 22 further comprising:

said process uses gas shielded metal arc welding;

said arc welding process is inert gas arc welding.

Claim 24. (Currently amended) A method of repairing a rail, which rail includes head, upright web and base sections, said method comprising the steps of:

a) identifying and locating a defect in the rail;

b) removing the defect from the rail by mechanically removing the defect and material surrounding the defect, so as to preserve the parent metal of the rail, form a void and a rail-void interface, while maintaining continuity of the base and at least a portion of the web of the rail;

c) filling the void with molten metal; and

d) causing the molten metal and the rail at the rail-void interface to bond;

wherein the void is filled with molten metal by one of arc welding[[;]], gas shielded arc welding or inert gas arc welding, which filling steps each cause said molten metal to fuse with the rail;

said molten metal is formed from a material resulting in a weld deposit having a carbon concentration of about 0.2% to 1.0% by weight.

Claim 25. (Currently amended) A method as in Claim 24 wherein the high carbon welding electrode produces a weld deposit from, by weight, about 0.2% to about 1.0% carbon, from about 1.8% to about 2.0% manganese, from about 0.5% to about 0.6% nickel and from about 0.5% to about 0.95% silicon.